The Volusian Water Alliance Water Supply Plan: A Regional Water Supply Planning Case Study

Robert A. Morrell, Barbara A. Vergara, Donald R. Feaster
Jerry Salsano, Brad Blais, Jo Ann Jackson, and Chris Gaw

In 1996 the St. Johns River Water Management District (SJRWMD) initiated water-supply planning throughout the entire district in response to the requirements of Executive Order 96-297 and Florida Statute 373.0361. These regulations mandated that all Florida water management districts develop regional water-supply plans with 20-year planning horizons. SJRWMD officials divided the district into several work group areas and initiated what was then called the "Water 2020" water-supply planning process.

Volusia County and vicinity was designated as Work Group Area II. The county had already identified the need for cooperative water-supply planning and had established the Volusian Water Alliance (VWA) as its countywide planning organization. The SJRWMD consequently contracted with the VWA to facilitate the water-supply planning process in Work Group Area II, which also includes portions of Flagler and Putnam counties.

The Volusian Water Alliance

The VWA is an intergovernmental planning body created by interlocal agreement in an effort to plan for future water-supply needs in a collective, coordinated, and cooperative manner within Volusia County. Its members operate under and are governed by this interlocal agreement as amended on November 16, 1999, via the First Amended Interlocal Agreement.

Initially, membership in the VWA consisted of 16 cities in the county and the Volusia County government, which was represented by a member of the county council; an agricultural representative; and a representative of Florida Water Services (FWS), a private water supplier to the city of Deltona and the largest privately owned public supply utility in the county.

Demand Projections

The primary focus of the water-supply plan is on the projected groundwater demands and potential impacts of those demands on the water resources of Work Group Area II, the study area. Total freshwater needs for the study area are categorized in Table 1, which summarizes the actual 1995 and projected 2020 groundwater demands for each category:

As indicated in the table, public supply is the largest groundwater use category, accounting for practically all the projected increase in demand. Consequently, the plan is focused on public supply. This focus, however, does not mean that other users do not contribute to the demands and to the potential impacts of those demands. Other users should also participate in the water-supply solution.

The 1995 and projected 2020 groundwater supply needs of the VWA public suppliers are summarized in five-year increments through 2020 in Table 2. The total public-utility supply projection of 89.21 mgd includes an additional 7.75 mgd of water demand for economic development above and beyond that included in individual utility projections. Six mgd of the additional demand was added to the Volusia County Utilities southwest service area (Glenn Abbey WTP). The other 1.75 mgd was for economic development in the general area of the Interstate 4-Interstate 95 intersection and was added to the projected demands of the Utilities Commission of New Smyrna Beach (UCNSB).

The total projected 2020 public supply demands represent an approximately 90-percent increase over the actual 1995 public supply water use of 47.61 mgd. The projections were developed based on 1995 water use. It is reasonable that if new projections were developed some utilities may wish to increase their projections based on the more recent experience.

Category	Ground Water Withdrawal *(mgd)*	
	1995	**2020**
Public Supply	47.72	89.21
Domestic self-supply	9.95	12.04
Agricultural self-supply	24.45	21.64
Recreational self-supply	7.63	10.91
Commercial/Industrial self-supply	0.69	0.99
Thermoelectric Power Generation[2] self - supply	0.37	0.66
O AL	**90.81**	**135.45**

[1] Proposed 2020 withdrawal may not be feasible.
[2] Thermoelectric power generation reflects increases on existing (as of 1995) plants only.

Alternative Water Supply Sources and Management Options

At present, nearly all the potable water supplied in the study area is withdrawn from the Floridan Aquifer. Any future sources of water, other than the existing or currently proposed (i.e., new wells or wellfields that utilities have proposed but have not yet constructed) withdrawals from this aquifer are considered alternative water sources for the

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Robert A. Morrell, P.E., DEE, is a vice president in the Orlando office of the engineering firm PBS&J. Barbara A. Vergara, P.G., is director of the Division of Water Supply Management with the St. Johns River Water Management District. Donald R. Feaster, P.E., is the executive director of the Volusian Water Alliance. Jerry Salsano, P.E., is president of Taurant Consulting Inc. in Longwood, a water-supply project manager for the St. Johns River Water Management District. Brad Blais, P.E., is a project manager with the consulting engineering firm of Quentin Hampton Associates in Port Orange. Jo Ann Jackson, P.E., is a senior engineer with PBS&J's Orlando office. Chris Gaw, E.I., is an engineer with PBS&J's Orlando office.

Table 2: PUBLIC SUPPLY WATER USE PROJECTIONS (5-YEAR INCREMENTS) [1, 2, 3, 4]

Utility/Service Area	Actual (mgd) 1995	Projected (mgd) 2000	Actual (mgd) 2000	Projected (mgd) 2005	Projected (mgd) 2010	Projected (mgd) 2015	Projected (mgd) 2020
Daytona Beach	12.42	13.66	13.73	14.90	16.13	17.37	18.61
DeLand	5.08	5.54	5.93	6.00	6.46	6.92	7.38
Edgewater	1.49	2.01	1.91	2.53	3.06	3.58	4.10
Deltona (FWS)	9.12	10.21	12.06	11.30	12.39	13.48	14.57
Holly Hill	1.16	1.27	1.30	1.38	1.48	1.59	1.70
Lake Helen	0.24	0.36	0.25	0.48	0.61	0.73	0.85
New Smyrna Beach (UCNSB) [5]	4.27	5.18	5.06	5.99	6.84	7.70	8.56
Orange City	1.33	1.63	1.44	1.93	2.22	2.52	2.82
Ormond Beach	4.90	5.37	6.10	5.83	6.30	6.76	7.23
Port Orange	5.28	6.02	5.82	6.76	7.50	8.24	8.98
Volusia County Utilities							
VC Deltona North	0.34	0.54	0.38	0.75	0.95	1.15	1.35
VC Northeast	0.19	0.30	0.20	0.41	0.52	0.63	0.74
VC Southeast	0.12	0.19	0.25	0.26	0.33	0.41	0.48
VC Southwest [5]	1.30	3.26	2.61	5.22	7.18	9.14	11.10
VC Ag Center	0.01	0.01	[6]	0.02	0.02	0.02	0.03
VC Cassadaga	0.01	0.02	0.03	0.03	0.03	0.04	0.05
VC Northwest	0.01	0.02	0.02	0.03	0.04	0.04	0.05
VC Spruce Creek	0.16	0.25	0.32	0.34	0.43	0.53	0.62
Volusia County Totals[7]	2.14	4.59	3.81	7.06	9.5	11.96	14.42
Totals	**47.44**	**55.79**	**57.41**	**64.15**	**72.50**	**80.86**	**89.21**

[1] Flow is actual annual average daily flow (ADF).
[2] Flow is for the calendar year in millions of gallons per day (mgd).
[3] These projected demands should be increased by 6% in order to adjust for a 1-in-10-drought year in accordance with SJRWMD.
[4] The projected flows presented in this table were developed in 1998. Since that time, individual utilities may have updated their specific 2020 projections. As of this date, Ormond Beach and Deltona (FWS) have both specifically revised their 2020 projections through recent CUP applications to 9.12 mgd and 16.76 mgd respectively.
[5] Final projections included additional capacity for economic development (1.75 mgd for UCNSB and 6.0 mgd for Volusia County Southwest).
[6] Breakdown by plant not available.
[7] Volusia County 2020 projections based on 3-percent growth per year from 2008 (2020 Demand - 2008 Demand*1.0312).

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plan. Potential alternative water-supply sources and management options available to reduce projected deficits in water supply for the study area are:

- System interconnections
- Surface water (fresh, brackish and seawater)
- Brackish groundwater
- Artificial groundwater recharge
- Reuse and water conservation
- Wetlands augmentation
- Aquifer storage and recovery (ASR)
- New fresh groundwater

Water Supply Plan Alternatives

The plan was based on the Volusia County and Vicinity (VCV) regional groundwater model and the associated optimization and decision models developed by the SJRWMD. The plan's development was marked by continuous refinements and upgrades of the SJRWMD models based on internal, work group, and peer review inputs.

The SJRWMD's groundwater optimization model considers the public water-supply needs as the only variable demand and treats all other needs as constants. The model output yielded sets of deficit projections based on projected water-supply needs. Deficits were defined as projected needs that can not be met by the existing or proposed groundwater supply sources without unacceptable impacts. Deficit sets developed from the optimization model varied significantly, based on the constraints that were applied to the optimization model.

In the process of evaluating and defining deficits, the following deficit issues were recognized by the VWA as critical to developing a water-supply plan. These issues were used as the basis for defining deficits and consequently developing solutions to eliminate them.

- Deficits belong to the study area – not to specific uses, users, or utilities.
- The primary criterion used in deficit development was minimization of the overall deficit for the study area without regard to deficit assignment or ownership.
- Ground water withdrawals throughout the study area are interrelated in that they all contribute to the cumulative impacts on the water resources of the area.
- The geographic distribution of deficits can be altered significantly by the constraints applied to the optimization model. Consequently, there are many deficit sets that are equally valid.
- Deficits developed for plan development purposes should not be directly applied in the permitting process.

In late 1999, utilizing the optimization model, deficit sets were defined by the SJRWMD based on the 1999 models and the applied constraints. Water supply options to be included in the alternative development were selected through a series of work group and VWA Technical Advisory Committee (TAC) and Board meetings. These options include:

- Existing and proposed fresh groundwater sources.
- New fresh groundwater sources.
- Fresh surface water supply.
- Interconnections.
- New brackish groundwater sources.

Application of the different management constraint conditions to the optimization model identified total study area deficits ranging between 20 and 25 mgd. Examples of management constraints are withdrawal limits, service area definition, and protection of existing investment in facilities (equity protection).

In mid-2000, SJRWMD made additional changes to the groundwater and optimization models that yielded total Study Area deficits of 7 to 10 mgd. The changes in the model results are indicative of the uncertainty of the planning tools available for developing the plan. Faced with the different 1999 and 2000 model results, the VWA Board decided to plan for deficits of approximately 20 mgd, based on the following factors:

- The existence of uncertainty within the modeling process, particularly with respect to the groundwater model projections of surficial aquifer drawdowns.
- The fact that minimum flows were not yet

established for Blue Spring in west Volusia County.

- The uncertainty associated with the projected demands. Some utilities have already indicated that their 2020 projected demands are low.
- The uncertainty of the implementation of recharge and reclaimed-water projects proposed to be in place on or before 2020.
- The fact that it is easier to plan for higher deficits and scale back plan options than it is to scale up the final plan.
- The fact that the 7-mgd to 10-mgd deficit is based on orchestrating a degree of optimization that may not be achievable.

Based on the 1999 model, five major alternatives were developed for consideration. These alternatives considered different management constraint sets and resulted in different water-usage rates from the potential water-supply sources. However, after review and evaluation of the alternatives by the VWA TAC and Managers Committee, the VWA Board decided that the best approach would be to develop the following plan.

Water-Supply Plan

The water-supply plan is based on a number of assumptions and understandings:

- Water utilities represent the only user group with significant need for increased water use between 1995 and 2020.
- Existing groundwater sources must be managed and combined with development of new water supplies to satisfy future, projected water-supply demands.
- The water resources of the study area should be developed in a manner that is in the best interest of the entire area as determined by the VWA, rather than in the best interest of individual water-supply utilities. This practice should not be interpreted to mean that all public supply utilities would be expected to share in the cost of development of all alternative water supplies. The cost of implementation of the plan is an issue that should be resolved by the VWA on a priority basis through an evaluation of various institutional alternatives for water-supply development.
- The plan must be flexible enough to accommodate future modeling improvements, changes in future demands, and changes in the environmental constraints.
- The plan should delay large capital investments as long as possible in order to minimize the potential for higher-risk, higher-cost expenditures related to modeling and other uncertainties.
- Evaluation of alternatives includes the understanding that in-the-ground transmission systems do not provide much flexibility for future modification of the plan.

The elements of the plan are based on the potential water-supply sources and management options available for the study area. Supply sources and management options that are part of the plan include: reuse and water conservation, wetlands augmentation, groundwater recharge, interconnections, and surface water. The incorporation of these supply sources and management options into the plan for the study area is discussed below.

St. Johns River Water Supply Project

The availability of a surface-water supply to make up for the projected deficits in future water-supply needs is a key element of the plan, which includes the development of 10 mgd annual average daily flow (AADF) of surface-water supply in southwest Volusia County. For planning purposes, the surface-water supply includes:

- Facilities to withdraw surface water from the St. Johns River.
- A surface-water treatment plant.
- Storage facilities.
- A pumping and transmission system capable of supplying peak demands of 17.5 mgd to existing water plants near the proposed plant site.

Conceptually, the surface-water treatment project is a regional surface-water supply facility that would withdraw water from the St. Johns River during periods of the year when the flow is sufficiently large to allow withdrawals. The water would be pumped to a surface-water treatment facility, and the treated water would then be pumped into a regional transmission system that would supply individual water-supply utilities through their own treatment facilities, where the flow would be rechlorinated and pumped to retail customers.

ASR is also part of the conceptual regional surface-water facility. ASR would allow treated surface water to be stored for recovery and pumping into the transmission system during periods of time when direct withdrawals from the river are not possible. ASR could also be used for storage at individual utility treatment facilities.

Regional Aquifer Management Project (RAMP)

The term *Regional Aquifer Management Project* (RAMP) has been developed to describe efforts to maximize fresh groundwater withdrawals. The VWA plans to develop 10 mgd of additional groundwater supply above that identified as available by SJRWMD models. Specifically, the RAMP goal is to develop five mgd of additional groundwater withdrawals through implementation of a

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Table 3: VWA WATER SUPPLY PLAN COST SUMMARY

Plan Components	Capital Cost (1999$)	O&M Cost (1999$)	Equivalent Annual (1999$)	Equivalent Annual Cost Per 1,000 gallon (1999$)
Surface Water (10 mgd)				
Treatment	72,500,000	3,580,000	9,910,000	
Transmission	10,025,000	3,322,000	1,569,000	
	$82,525,000	***$6,902,000***	***$11,479,000***	***$3.14***
RAMP[1] (10 mgd)				
Rima Ridge Wetland Augmentation Project	40,750,000	571,000	2,330,000	
DeLand Ridge Artificial Recharge Project	40,750,000	571,000	2,330,000	
Rima Ridge Raw Water Interconnection	8,580,000	77,000	1,016,000	
DeLand Ridge Raw Water Interconnection	8,010,000	77,000	1,092,000	
	$98,090,000	***$1,296,000***	***$6,768,000***	***$1.85***
Total (20 mgd)	**$180,615,000**	**$8,198,000**	**$18,247,000**	**$2.50**

[1] RAMP is an acronym for Regional Aquifer Management Project. It includes several options that will help maximize fresh groundwater withdrawals.

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Rima Ridge RAMP in east Volusia County and another five mgd through a DeLand Ridge RAMP in west Volusia County.

Together, the RAMP and St. Johns River projects could result in 20 mgd of additional potable water supply for VWA member utilities, which would benefit all the water users in the study area. The VWA has initiated a RAMP work effort that would identify potential RAMP projects and evaluate and implement these projects. This work effort will specifically identify potential projects, investigations, and other initiatives that would achieve the RAMP goal.

The Rima Ridge RAMP as conceived in the plan will consist of the pumping, storage, and additional treatment of reclaimed water and stormwater, as well as a transmission system that would introduce this treated water into several locations along the western wellfields in east Volusia County. The reclaimed water would be pumped from a location near the Daytona Beach Regional Water Reclamation Facility to a constructed wetlands treatment system and subsequently introduced to natural wetlands in the vicinity of the western wellfields.

The DeLand Ridge artificial recharge project is less specifically defined in the plan, but it will likely consist of a series of RIBs that are located strategically to recharge the aquifer and allow additional pumping. The utilities in the west Volusia County area do not have as much excess reclaimed water available that could be used for this purpose; consequently, the DeLand Ridge recharge project may require use of surface water for recharge.

The RAMP also includes interconnections to allow groundwater to be transferred between utilities to help optimize groundwater withdrawals and more effectively minimize adverse environmental impacts.

Cost of Plan

The estimated cost of the proposed plan is summarized in Table 3. These estimated costs are very preliminary and significantly uncertain. The equivalent annual cost per 1,000 gallons of water based on these estimates provides an indication of the potential long-term rate impact of the new water. Actual rate impacts must be evaluated on a utility-by-utility basis and require a much more detailed analysis. It should be remembered, however, that rate impacts can be mitigated by:

- Outside funding sources.
- Blending water rates from existing water sources.
- Use of impact/connection fees.

Conclusions and Recommendations

The conclusions of the water supply plan are:

- The major utilities in Volusia County accounted for approximately 57 percent of the estimated 1995 groundwater withdrawals and 72 percent of the 2020 projected demands.
- The utilities account for practically all the 41.8-mgd of total additional demands projected. For that reason, the plan is focused on alternatives to meet the additional public supply-utility demand.
- Population-based water-use projection models developed by the SJRWMD indicate that 20 to 33 mgd of the projected increased demands can be met with existing groundwater sources.
- The current planning tools indicate that existing water sources will be sufficient to meet VWA needs from 2009 to 2017.
- Water conservation and reclaimed-water reuse have the potential to significantly reduce the need for alternative water supplies before 2020; however, it is difficult to predict the effectiveness and cost of conservation and reuse on a regional scale.

The recommendations of the water supply plan are:

- Participation from other use classifications should include cost sharing, conservation, and reuse.
- Alternative sources should be in use sometime between 2009 and 2017, or before the utility demands increase to 70 to 83 mgd.
- VWA utilities should continue to aggressively implement cost-effective water-conservation and reuse measures.
- The VWA should institute the practice of requiring each utility to report the total water supplied to single-family residential customers and the corresponding number of customers. This data should be provided at the beginning of each year for the previous calendar year. This would allow the VWA to calculate the average gpd per single-family residential connection as an indication of a comparative measure of performance to assist in evaluating the effectiveness of water conservation and reuse.
- The VWA should also continue the practice of reporting the total reclaimed water used as a percentage of available reclaimed-water supply on a utility-by-utility basis.
- VWA utilities should preliminarily plan to develop up to 10 mgd of alternative water supply from the St. Johns River for use by public supply utilities.
- VWA utilities should implement RAMP with the goal of developing 10 mgd of additional fresh groundwater.
- While planning for surface water, efforts should be made to assess timing requirements and wisely program full implementation of the surface-water supply option and associated capital costs. These efforts should include:
  - Refining models and constraints to better define impacts of additional groundwater withdrawals.
  - Refining projections to better define needs.
  - Developing RAMP to result in additional groundwater availability, including the implementation of cost-effective interconnections to allow more flexibility to manage existing groundwater sources.
  - Continued monitoring of the ongoing St. Johns River Water Supply Project by the VWA to better define the cost and feasibility of surface water.
  - Monitoring by the VWA of the cost-effectiveness of seawater desalination as an alternative water supply option.
  - Monitoring by the VWA of regional efforts to evaluate the cost-effectiveness and feasibility of direct injection of surface and reclaimed water into the potable aquifer to enhance the recharge of groundwater sources.
- The VWA should focus attention on developing acceptable cost-sharing scenarios between public supply and other use classifications and between utilities.
- The VWA should evaluate and study the institutional alternatives and funding options available and take the necessary steps to ensure the provision of an adequate, affordable, and sustainable future water supply that does not adversely impact the environment.

Plan Implementation

The VWA has begun the process of implementing the plan recommendations. The two most significant actions taken thus far are planning and implementation of RAMP and performance and implementation of the recommended study of institutional alternatives.

Four RAMP projects have been approved for funding, which will come in part through the Florida Forever Program and in part from the project owners. In addition, the *Volusian Water Alliance Governance Study* was completed in May 2002 and was subsequently approved by VWA. A transition team has been appointed to effect the creation of a new water governance unit that will be responsible for the development and wholesale of new water supplies to member utilities. The transition team is scheduled to complete its task in October 2003.